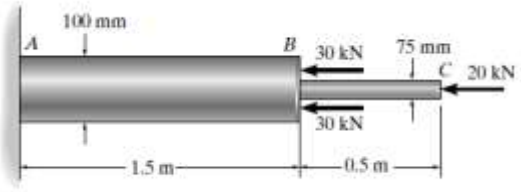
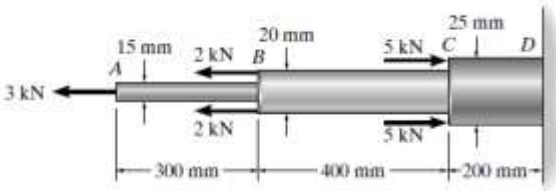
Strain Energy and Deflection Problems

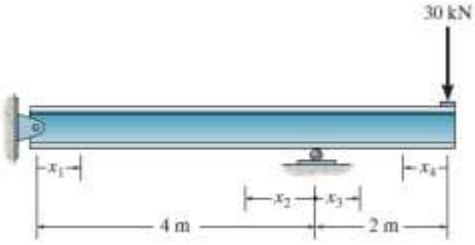
14–3. Determine the strain energy in the stepped rod assembly. Portion AB is steel and BC is brass. $E_{br} = 101$ GPa, $E_{st} = 200$ GPa, $(\sigma_Y)_{br} = 410$ MPa, $(\sigma_Y)_{st} = 250$ MPa.



•14–5. Determine the strain energy in the rod assembly. Portion AB is steel, BC is brass, and CD is aluminum. $E_{st} = 200$ GPa, $E_{br} = 101$ GPa, and $E_{al} = 73.1$ GPa.

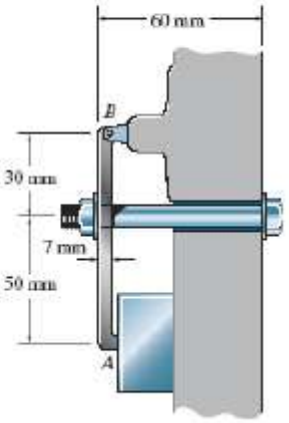


***14–16.** Determine the bending strain energy in the A-36 structural steel W250 × 18 beam. Obtain the answer using the coordinates (a) x_1 and x_4, and (b) x_2 and x_3.

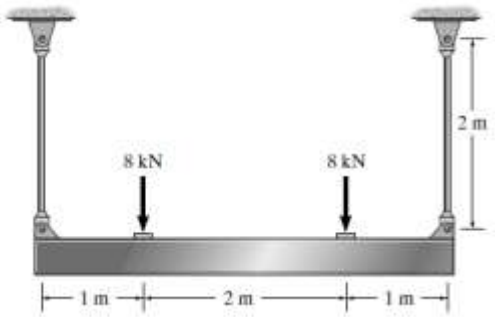


Problem 14-19

The bolt has a diameter of 10 mm, and the link AB has a rectangular cross section that is 12 mm wide by 7 mm thick. Determine the strain energy in the link due to bending and in the bolt due to axial force. The bolt is tightened so that it has a tension of 500 N. Both members are made of A-36 steel. Neglect the hole in the link.

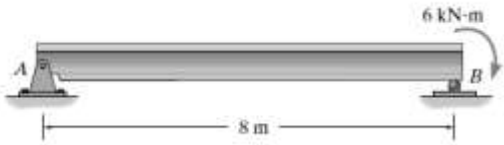


*14–20. Determine the bending strain energy in the beam and the axial strain energy in each of the two rods. The beam is made of 2014-T6 aluminum and has a square cross section 50 mm by 50 mm. The rods are made of A-36 steel and have a circular cross section with a 20-mm diameter.



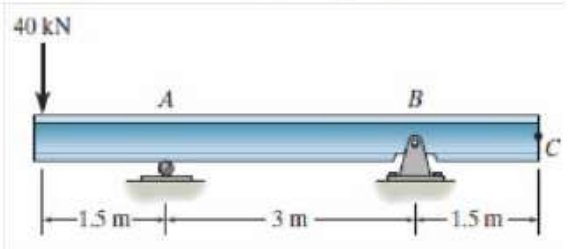
14–31. Determine the slope at the end B of the A-36 steel beam. $I = 80(10^6)\ \text{mm}^4$.

$$M = -750x$$



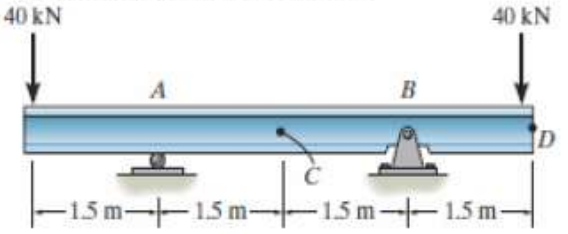
Problem 14-91

Determine the displacement of point C of the beam made from A-36 steel and having a moment of inertia of $I = 21(10^6)\ \text{mm}^4$.



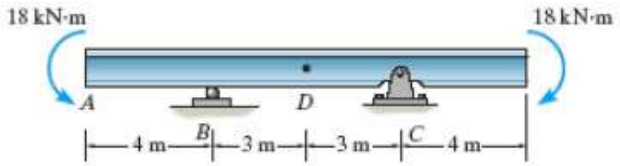
Problem 14-93

Determine the displacement of point C of the W360 X 39 beam made from A-36 steel



Problem 14-101

The A-36 steel beam has a moment of inertia of $I = 125(10^6)\ \text{mm}^4$. Determine the displacement at D.



Problem 14-160

The L2 steel bolt has a diameter of 5 mm, and the link AB has a rectangular cross section that is 10 mm wide by 4 mm thick. Determine the strain energy in the link AB due to bending, and in the bolt due to axial force. The bolt is tightened so that it has a tension of 1750 N. Neglect the hole in the link.